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KNOW YOUR FARM MACHINERY COSTS

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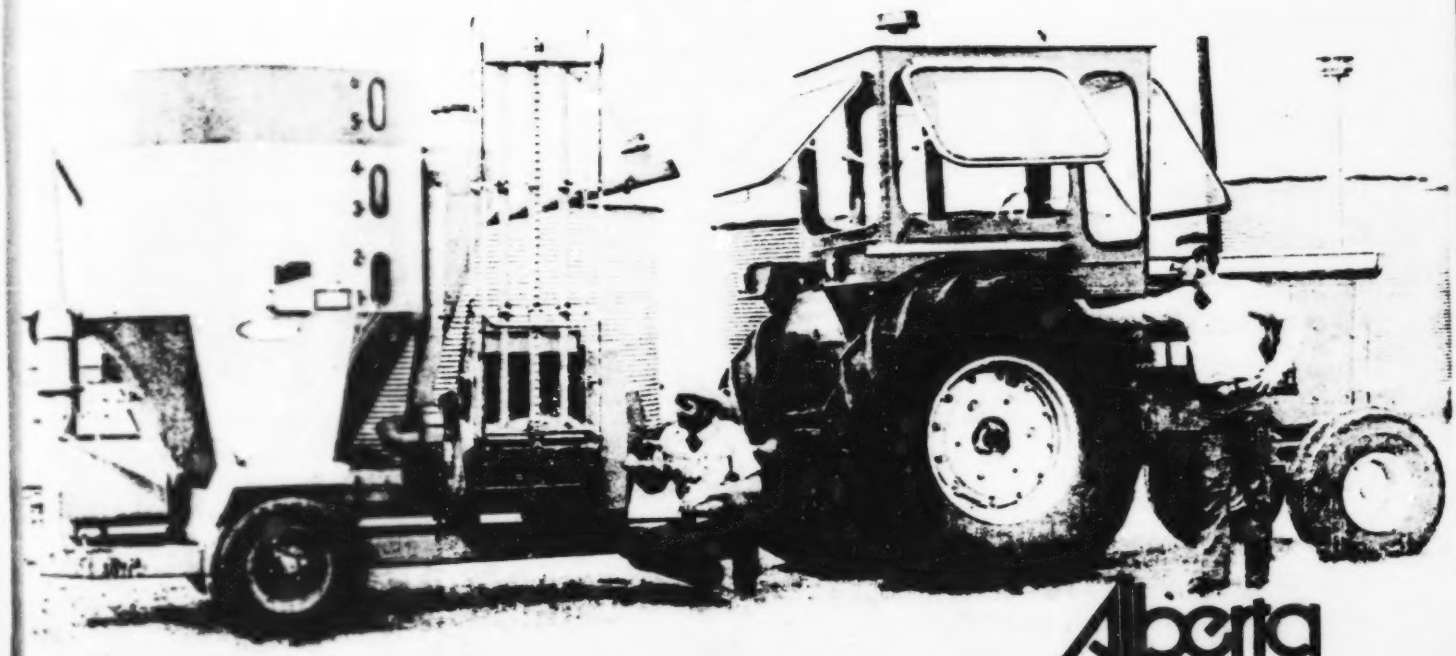

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KNOW YOUR FARM MACHINERY COSTS

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AGRICULTURE
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PREFACE

Farming today is big business, and machinery comprises one of the most important capital inputs in farm production.

In farm machinery planning, the good manager analyzes the effects of a given decision on both his cost and on the timeliness of the operations. The manager is usually aware of the costs involved and how these costs affect the profitability of the farm.

This publication is intended to provide you, the farm manager, with detailed information on how to estimate costs for owning and operating farm machinery. The publication also provides information on sizing machinery and some of the alternatives to machinery ownership. Once a manager knows how to estimate total machinery costs and the costs associated with the alternatives, the manager should have a much easier time coming up with profit - making decisions.

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TABLE OF CONTENTS

INTRODUCTION 1

FIXED COSTS 1
- Depreciation 2
- Investment Cost 4
- Insurance And Housing 4

VARIABLE COSTS 4
- Fuel 5
- Lubrication 5
- Repairs and Maintenance 5
- Labor 7
- Dependability 7

OTHER COSTS 7
- Timeliness 7
- Tax Considerations 8

HOW TO USE COST INFORMATION 10
- Machinery Size 11
- Labor vs Machinery 12
- Shared Ownership 12
- Leasing Or Custom Hiring 12
- When To Trade 13
- Custom Work 13

CONCLUSION 14

APPENDIX 1 - Fuel Consumption For Varying Tractor Horsepower (Kilowatt) 16

WORKSHEETS . . . . . 18 & 19

INTRODUCTION

Modern farming techniques call for the use of large expensive machines. The cost of owning and operating machinery is an ever increasing portion of total farm costs, currently being second only to land costs as a production input. Farmers are often critical of this machinery cost situation, wondering where it will all end. But, whatever the cause, farmers must adapt if they want to continue farming. They must know in advance the consequences of a decision involving machinery because as prices rise, so does the cost of an error in judgment. In short, modern farmers must become better machinery managers.

What sort of questions should a skilful machinery manager be asking? What must he know before walking into the local dealer's front door? Initially he must be familiar with his present situation. How much work does he have and how long does he have to do it? What are his current machinery costs? He must then decide how much equipment to own and what size it should be, keeping in mind the effects on overall net farm profit. Other important decisions involve how often machinery should be traded and whether leasing or custom hiring would be more profitable. All too often, farmers claim they cannot take time to answer these questions. Successful farmers claim they cannot afford not to make time!

It is very important that the farmer be "on top of" his present situation. He must know what his existing machinery costs are before he can measure the financial consequences of a machine purchase or trade. A thorough knowledge of the various kinds of costs involved with machinery ownership and use is thus required. This publication attempts to explain these costs in detail and show how this information can be used to assist farmers with their machinery management questions.

FIXED COSTS

Many farmers are uncertain as to what and how to calculate fixed costs and thus do not consider them when purchasing equipment. Fixed or ownership costs are those costs which do not change regardless of annual use of the machine. The more hours a machine is used per year, the less will be

the fixed costs per hour of use. For example, consider two farmers with 100 hp (75 kilowatts) tractors, one who works 800 hours per year and one who works 600 hours per year. Since each has the same sized tractor, the total annual fixed costs of each are approximately the same, but the farmer who works 800 hours per year has a lower fixed cost per hour of use than the one who works only 600 hours per year. (see worksheet on page 18 and 19).

Fixed costs are a large part of the total cost of machinery ownership and use. Fixed costs begin with the purchase of the machine, continue as long as it is owned, and cannot be changed by the manager except by selling the machine. Fixed costs can represent 50 to 80 per cent of the total annual costs. The former figure is applicable to motorized machinery and the latter to tractor drawn implements. As a very general rule of thumb, annual fixed costs will be about 20 per cent of the original cost, depending on the type of machine, opportunity cost of capital, and the expected useful life. The components of machinery fixed costs are examined below.

Depreciation

To properly evaluate management depreciation, from a planning point of view, all factors contributing to the cost difference between used and new machines of equal capacity must be considered. This includes inflation as well as age, wear and obsolescence costs. It is calculated before tax and its formula is as follows:

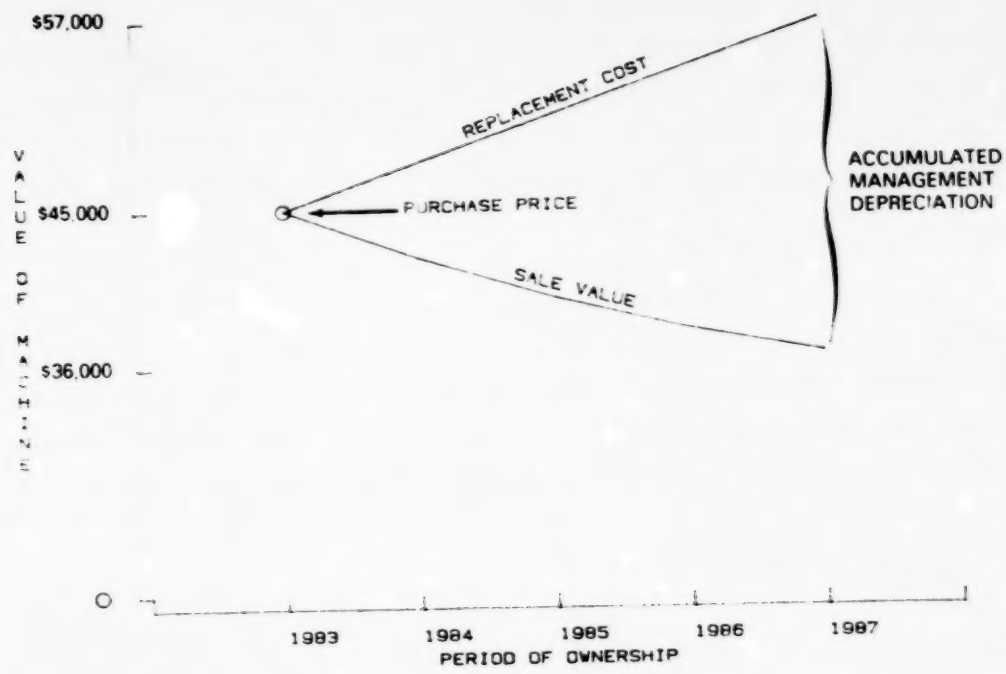
$$\text{Annual Management Depreciation} = \frac{\text{Replacement Cost - Sale Value}}{\text{Years Of Use}}$$

- "Replacement Cost" is the cost of a new machine of equal capacity

- "Sale Value" is the value of the machine at the end of the ownership or planning period

- "Years Of Use" is the number of years in the ownership or planning period

Graphically the above formula is illustrated below.



An example of management depreciation may be as follows:

Purchase Price of new 100 hp (75 kw) Tractor in 1983 =	$45,000
Purchase Price of new 100 hp (75 kw) Tractor in 1987 =	$57,000
Cash Sale Price of old 100 hp (75 kw) Tractor in 1987 =	$35,000
Age of old 100 hp (75 kw) Tractor =.....	5 years

$$\text{Average Annual Management Depreciation} = \frac{\text{Replacement Cost - Sale Value}}{\text{Years of Use}}$$

$$\frac{\$\ 57,000 - \$35,000}{5 \text{ years}} = \$\ 4,400 \text{ per year}$$

Accumulated Management Depreciation = $22,000 for 5 years

Many farmers think management depreciation and capital cost allowance (CCA) are the same. They are NOT. The calculation for CCA is explained on page 9 of this publication.

Investment Cost

Ownership of machinery ties up capital which could otherwise be earning interest. Interest on investment is the cost of this capital whether it be interest paid on loans or interest not earned on the farmer's own money.

$$\text{Average Annual Investment Cost} = \frac{\text{Original Cost} + \text{Sale Value}}{2} \times \text{Interest Rate}$$

The original cash cost is used here because this is the amount of capital tied up by the machine. When added to the cash sale value and then divided by two, you get the average annual value of the investment over the years of ownership. Multiplying by the current bank interest rate gives income not received because of the machinery investment.

Insurance and Housing

The fixed cost of insurance is the premium paid for protection of equipment from fire, theft, vandalism and highway travel. Obviously this is a fixed amount per year that does not vary with machine use. Housing costs are usually charged even when not provided since unprotected machines usually have a higher repair cost owing to deterioration by weather. When actual costs are not available for insurance and housing, 1.0 per cent of the machine's original cost is usually charged.

TO SUMMARIZE, FIXED COSTS IN TOTAL ARE CONSTANT ANNUAL AMOUNTS, HOWEVER, AS MACHINE USE INCREASES, THE FIXED COST PER HOUR OF USE (OR BUSHEL [TONNE] OF GRAIN PRODUCED) DECREASES.

VARIABLE COSTS

Variable costs, also called operating costs, are the opposite to fixed costs. They are constant per unit (hour, gallon [litre], acre [hectare], etc.) but vary in total with the amount of annual machine use. Consider variable costs in our earlier tractor example. The two farmers face the same operating costs per hour, however, the one using his tractor 800 hours has a higher total variable cost per year because he works more hours.

Common variable costs associated directly with production are fuel, lubrication, repairs, maintenance and labor.

Fuel

This cost is determined by fuel consumption per hour and price per litre. Actual cost will vary, however, with the size and type of engine as well as the work load. Average fuel consumption figures for tractors are listed on page 16 of this publication.

Lubrication

The cost of lubrication varies directly with fuel cost since it is directly proportional to hours of use. If actual costs are unavailable, it is usually estimated at 15 per cent of fuel costs.

Repairs And Maintenance

Actual costs from farm records are desirable since repairs are difficult to estimate, but when estimates are necessary, the following "straight-line" formula can be used:

$$\text{Repair Cost} = \frac{\text{Original Cost X Annual Repair Rate}}{\text{Hours Annual Use}}$$

Suggested annual repair rates and average hours of use appear in the following table (page 6). The rates are calculated from average total repair costs occurring over the lifetime of the machine. Remember that wide variations may occur with individual machines in individual years.

MACHINERY COSTS ASSUMPTION GUIDE

MACHINE	A Depreciation Lifetime (Years)	B Annual Use (Hours)	C Annual Repair rate % orig.Cost	D Lifetime Repairs % orig.Cost	E Field Efficiency
Tractors	13	600	3%	120%	.....
Combines	12	150	3%	60%	60 - 80%
Cultivators	15	250	3-8%	120%	70 - 90%
Discers	15	150	3%	120%	70 - 90%
Rodweeders	15	100	2%	100%	70 - 90%
Seed Drills	15	100	2%	100%	65 - 80%
Harrows, Packers	15	40	2%	120%	70 - 90%
Sprayers	15	50	2%	80%	50 - 80%
Stone Pickers	15	40	2%	100%	50 - 80%
Swathers	15	100	3%	95%	70 - 85%
Mowers & Rakes	15	50	2%	100%	60 - 90%
Mower-Condtioner	15	50	2%	100%	60 - 85%
Forage Harvester	15	80	3%	80%	50 - 80%
Balers					
Standard	10	80	3%	80%	60 - 85%
Large Round	12	60	2%	60	60 - 85%
Grain Dryers	12	200	3%	...	.....
Loaders	15	40	2%	90%	.....

Notes On Column Headings

A. Estimated average number of years until a machine depreciates to 10 per cent of original cash cost

B. Estimated average annual farm use

C. Estimates are based on average conditions and the indicated annual hours of use

D. Total repairs as a per cent of the original cash cost. Repairs are usually low in the first years before they begin to rise at an increasing rate as the machine wears out. These figures could be viewed as a maximum since they reflect high rates in later years.

E. Field efficiency is a percentage estimate of the amount of time machinery is actually in use relative to the total time required to complete an operation.

Labor

This cost is not on the worksheet since profit earned is usually designated as return to management and operator labor. However, when hired labor must be used to operate equipment, it should be included to give an accurate total variable cost.

Dependability

Costs, in addition to repairs, occur when a machine breaks down. Dependability cost is the income that is lost by not completing a job on time. These costs are difficult to establish since there is no cash outlay and breakdowns are unpredictable, but on the average, downtime does increase with machine use. This lost income is not included on the worksheet, but it does exist and is paid by the farmer over the year's operation.

IT IS IMPORTANT TO NOTE THE RELATIONSHIP THAT EXISTS BETWEEN FIXED AND VARIABLE COSTS. AS MACHINE USE (AND TOTAL COST) INCREASES, THE FIXED COST PORTION DECREASES RELATIVE TO THE VARIABLE COST PORTION. MINIMUM TOTAL COST PER UNIT OCCURS WHEN THE DECREASE IN THE FIXED COST PORTION EQUALS THE INCREASE IN THE VARIABLE COST PORTION (IN ACTUAL DOLLARS). The accompanying worksheet enables the farmer to compare his fixed and variable costs and will guide him toward proper equipment capacities and lower total costs.

OTHER COSTS

Timeliness

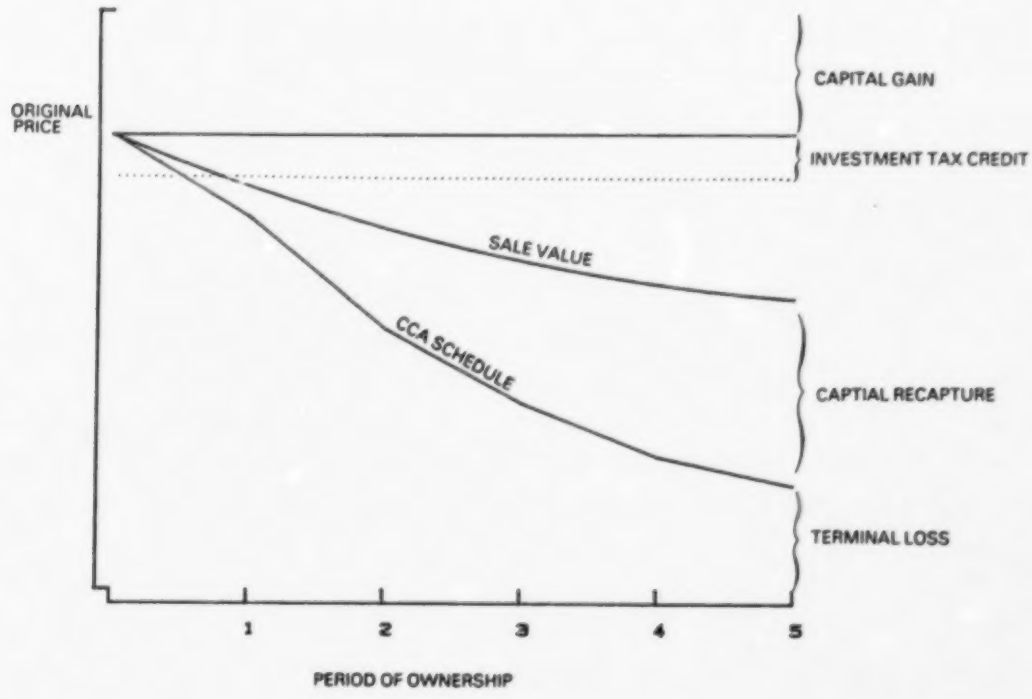
Timeliness is a cost similar to dependability, however, it relates to machine size rather than breakdowns. Timeliness cost is income lost from reduced yields and quality when operations are not completed at optimum times. For example, as mature grain dries, there is a weight loss resulting in fewer bushels harvested. Such penalty costs must be weighed against additional costs of larger equipment until a point of minimum total costs is reached.

Again, this cost is not on the worksheet because of its wide variability; however, a good farm manager will be able to measure it from accurate production and available field time records.

Tax Considerations

In some cases, taxes can influence machinery planning decisions. Capital cost allowance (CCA), for example, is a portion of management depreciation that is tax deductible, thus representing a dollar saving. The size of this saving depends upon the farmer's marginal tax rate. Similarly, variable costs (operating costs) represent further dollar savings by reducing taxable income.

The "investment tax credit" of recent years is somewhat different. This provides a direct cash saving by reducing taxes payable. Thus, when planning costs for new machinery, the amount of this tax credit should be initially subtracted from the purchase price of a new machine if the farmer faced payable income taxes in the current year. Graphically, the tax consequences of a purchase and sale of a machine is illustrated below.



If the previous example is used again and the tax structure does not change in the next five years, the CCA for the tractor would be as follows:

Purchase Price of New 100 hp (75 kw) Tractor in 1983 = $45,000
Cash Sale Price of 100 hp (75 kw) Tractor in 1987 = $35,000
Age of 100 hp (75 kw) Tractor = 5 years
CCA Rate for Tractor = 30%
Business Investment Tax Credit [1] = 7%

CCA: Year 1 = Purchase Price - BITC x 15%[2]
$45,000 - $3,150 x 15% = $ 6,278

Year 2 = Undepreciated Balance x 30%
$35,572 x 30% = $10,672

Year 3 = $ 24,900 x 30% = $ 7,470

Year 4 = $17,430 x 30% = $ 5,229

Year 5 = $12,201 x 30% = $ 3,660

Since the tractor is sold for more than the CCA book value, recapture applies. Recapture is calculated by subtracting book value from sale value.

Recapture = Sale Value - CCA Book Value = $35,000 - $ 12,201 = $22,799

Recapture is added to taxable income and thus is fully taxable.

Since most farmers do not liquidate machinery unless they are going out of business, recapture usually decreases the allowable depreciation in the class that the machine is in.

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1 In parts of Canada BITC is 10 per cent. Check with Revenue Canada for the rate in your area.

2 In the first year, the CCA rate for a new machine is half of the normal rate.

If the tractor is sold for less than the CCA book value, terminal loss applies. Terminal loss is calculated the same way as recapture, except that it is a negative number.

If the tractor is sold for more than its original value, capital gain comes into effect, and only half of the gain is taxable. It is suggested that the gain be reported as capital gain and not as recapture for that class, since capital gain is half taxable, whereas recapture is fully taxable when the class is liquidated.

IT SHOULD BE MENTIONED THAT PURCHASING EQUIPMENT SOLELY FOR SHORT TERM INCOME TAX SAVINGS IS USUALLY NOT A PROFITABLE MANAGEMENT STRATEGY. OFTEN THE LONGER TERM INCREASE IN FIXED COSTS FAR OUTWEIGHS THE SHORT TERM TAX SAVING.

HOW TO USE COST INFORMATION

Now that we know what machinery costs are, how can we use them to assist in proper decision making? The concept of fixed and variable costs was explained earlier using the example of two identical tractors using 800 and 600 hours per year respectively. Calculations of actual costs of these two tractors appear on two completed worksheets attached to this publication.

Assuming that the production per hour is the same for both machines, the tractor used for 800 hours costs less to operate per hour. The result is more profit! This concept is important for machinery size decisions since a fully utilized machine results in lower production costs.

The key to profitable machinery management lies in balancing the benefits of maximum machine utilization against the losses caused by not getting the job done in the most timely manner. These timeliness losses occur when yield is decreased as a result of not completing a particular operation on time. Such losses are hard to estimate in dollar terms since they vary from crop to crop, farm to farm, and year to year, but most farmers realize that they do exist and can be very costly during critical times of the year.

Machine Size

When thinking about timeliness losses, the question first asked is "How big should my machinery be in order to maximize net profit?" To solve this problem, the farmer must know two things, - how much work he has to do and how long he has to do it. With this in mind he can shop for equipment of sufficient capacity to meet his needs. A handy formula for calculating machine capacity, is as follows:

$$\text{Acres Per Hour} = \frac{\text{Machine Width (ft) X Speed (MPH) X Field Efficiency (\%)}}{8.25}$$

$$\text{Hectare Per Hour} = \frac{\text{Machine Width (m) X Speed (km) X Field Efficiency (\%)}}{10}$$

The field efficiency factor allows for such things as lubrication, overlap, turning, lunch time, and anything else that might stop the machine during available working hours. For example, the field efficiency of a cultivator might be 80 per cent whereas a seed drill could be around 65 - 80 per cent. These figures can be easily arrived at by comparing the actual time spent working (keeping a record on the tractor) to the working hours available. Field efficiency for various operations are listed on page 6 of this publication.

An example of the above formula is where a 31' (9.3 m) cultivator travelling at 5 MPH (8 KmPH) and operating at 80 per cent field efficiency would have an effective field capacity of:

$$\text{Acres per hour} = \frac{31 \times 5 \times .80}{8.25} = 15 \text{ ac/hr}$$

$$\text{Hectares per hour} = \frac{9.3 \times 8 \times .80}{10} = 6 \text{ ha/hr}$$

When considering machines of various sizes, all of which must meet the farmer's minimum capacity requirements, it is useful to calculate the costs that will be incurred over the period of ownership for each machine. The

attached worksheet can be used for this purpose, or alternatively, computer programs are available that provide the necessary calculations. These calculations will show the different costs paid by the farmer for machines of different sizes and thus will measure the price paid for a bigger machine.

Labor vs Machinery

Before the new, larger machine is purchased, consider the alternative of hiring more labor to operate smaller equipment more hours.

It is simple to compare the added cost of larger equipment with the added cost of additional labor required to complete the farming operations on time. In some cases where full-time or part-time labor is available, this may be a very economical alternative.

Shared Ownership

Often, a considerable cost saving results from shared ownership of equipment. Two farmers who purchase a rock picker together can save one half of the ownership costs involved and still have adequate use of the machine. A lot of farm equipment lends itself to joint ownership with the major problem being how well the owners get along. Farm syndicate loans are available to groups of farmers who purchase equipment jointly. Further benefits are possible from economies of scale realized when large farm equipment is used more efficiently. This aspect of machinery ownership can be a cost saving alternative for the farm manager who is willing to sacrifice a little independence.

Leasing Or Custom Hiring

One can see that machinery costs vary considerably among farmers. Consequently, for some farm managers, machinery leasing or custom hiring for some or all farming operations may be a less expensive alternative. Generally speaking, the greater the potential cost faced by a farmer for timeliness losses, the more feasible leasing or custom hiring can be, even if it only supplements an existing line of equipment.

The manager who knows his own costs can compare them with local custom rates or leasing fees to see if this is an alternative for him.

The attached worksheet or an available computer program can supply the cost information necessary for the proper management decision.

When To Trade

Deciding on the best time to trade a machine can be a very confusing thing for most farm managers. Many find that approaching this problem from a cost point of view can be very helpful. As equipment ages, repair costs tend to increase. The attached worksheet will indicate what an existing piece of equipment is costing. Comparing this to the projected annual cost of a new machine indicates which one is the least costly. Before making a final decision, however, carry the analysis a step further. A new machine is probably more dependable. This can be very important when timeliness losses are potentially high. Thus, an estimated cost for dependability should be assessed for the old machine. In addition, modern farm equipment tends to become obsolete as technology advances. A new machine could possibly boost production by improving weed control, reducing fuel consumption or increasing field efficiency. Even an air conditioned tractor cab can increase productivity if it results in more time in the field or less operator fatigue. Such benefits should be evaluated by the farm manager and added on to the cost of the old machine. This analysis indicates when the cost of the old equipment is greater than the cost of the new equipment, telling the farmer that it is time to trade. This same process can be used for deciding whether to purchase new or used equipment as well as indicating when to trade.

Custom Work

Operators who purchase farm equipment to do custom work, either full-time or part-time, must have machine cost information to guide their decision making. Particular costs that are relevant depend upon the amount of custom work being done. A full-time custom operator must cover total cost plus a profit margin while a neighbor doing only a small amount may wish to cover only his variable costs. Between these extremes is the farmer who does custom work after completing his own operations and purchases machinery accordingly. He expects to cover a portion of his fixed costs, or ownership costs, as well as his custom operating costs on the custom acres (hectares). The following formula will assist him in determining the portion of annual fixed cost to cover in his custom rate.

$$\frac{\text{Hours Of Custom Work}}{\text{Total Annual Machine Hours}} \times \text{Total Annual Fixed Costs}$$

If we use the previous example of the tractor with 800 annual hours of use and assume 200 hours are for custom work, annual fixed cost of the tractor to cover his custom rate would be:

$$\frac{200}{800} \times \$8,850 = \$\ 2,212.50$$

If an operator or a farmer wants to know the number of acres (hectares) he has to work in order to break even, the following formula can be used.

$$\text{Break-Even Acres} = \frac{\text{Average Annual Fixed Cost}}{\text{Custom Rate/Acre - Variable Cost/Acre}}$$

$$\text{Break-Even Hectares} = \frac{\text{Average Annual Fixed Cost}}{\text{Custom Rate/Hectare - Variable Cost/Hectare}}$$

For example if the average annual fixed cost of a new combine for the next five years is $ 18,750 per year, and the custom rate for combining is approximately $15/Acre (37.06/Hectare) and the variable costs are $3.50/acre, (8.65/Hectare) the number of acres (hectares) required to break even are:

$$\frac{\$18,750}{\$15 - \$3.50} = 1,630 \text{ acres}$$

$$\frac{\$18,750}{\$37.06-8.65} = 660 \text{ hectares}$$

Thus, if a custom operator does more than 1630 acres (660 hectares) a year, operating the combine is profitable. On the other hand, if a custom operator and a farmer (assuming they use the same machine, and costs are the same) do less than 1630 acres (660 hectares), the use of that combine is NOT profitable.

CONCLUSION

It takes time to arrive at an accurate cost picture for your machinery, but most successful farmers claim it is time well spent. It can take many long hours of hard work to pay for the cost of one bad machinery management decision. Many factors can influence such decisions, some of them not

financial, but the good manager knows what he can or cannot afford. The final decision is his!

FURTHER INFORMATION:

Alberta Agriculture, Custom Rates Annual Survey Summary, Agdex 825-9

Alberta Agriculture, Custom Farming Agreement, Agdex 817-10

Alberta Agriculture, Farm Machinery Costs, Agdex 825-12

Alberta Agriculture, Farm Machinery Costs As A Guide To Custom Rates, Agdex 825-4

Alberta Agriculture, Leasing Farm Machinery, Agdex 825-13

Alberta Agriculture, Planning Farm Machinery Costs, Agdex 825-5

Alberta Agriculture, What Is A Fair Charge For Custom Work? Agdex 825-15

Couture, Marcel J. Farm Business Management, Macdonald Campus of McGill University, Ste Anne-de-Bellevue, Quebec. Jul. 1980

Fundamentals Of Machine Operation, Machinery Management, 1975, John Deere, Service Publication, Department F, John Deere Road, Moline, Illinois,61265, U.S.A.

Kay, Ronald D. Farm Management, Planning, Control And Implementation, McGraw-Hill Book Company, 1981.

APPENDIX 1

FUEL CONSUMPTION FOR VARYING TRACTOR HORSEPOWER[1]

TRACTOR TYPE AND SIZE	AVERAGE DRAWBAR HORSEPOWER[2]		AV. FUEL CONSUMPTION[3] (Litres per Hour)	
	Diesel Tractors	Gasoline Tractors	Diesel Tractors	Gasoline Tractors
Two Wheel Drive PTO HP				
30 - 39	....	31.5	....	10.5
40 - 49	....	38.3	....	12.3
50 - 59	48.2	47.1	10.5	15.0
60 - 69	56.2	55.2	13.6	20.0
70 - 79	65.5	64.5	16.4	23.2
89 - 89	73.5	74.5	17.7	26.8
90 - 99	84.0	82.0	20.5	28.2
100 - 119	90.3	....	22.7	....
120 - 139	111.6	....	28.2	....
140 - 159	128.9	....	32.3	....
160 - 179	145.8	....	38.6	....
Over 180	148.9	....	39.1	....
Four Wheel Drive DBHP				
100 - 149	135.0	....	33.2	....
150 - 174	159.4	....	40.3	....
175 - 199	182.8	....	50.0	....
200 - 224	217.4	....	53.0	....
225 - 249	235.5	....	58.0	....
250 - 274	265.0	....	61.4	....
275 - 299	281.3	....	62.6	....
300 - 349 *	305.0	....	66.4	....
Over 350 *	385.0	....	92.4	....
* Includes only one tractor				

1 This data was summarized from "Nebraska Tractor Test Summary 1972 through 1981", "The Grain Grower, Page 762 (UGG), April, 1982 and from 1980 - 1981, Agricultural Yearbook, A.S.A.E., May, 1980, pp 537-545.

2 Average Drawbar Horsepower for all tractors in each range.

3 Average fuel consumption for all tractors in each range.

Notes On Fuel Consumption Table

This data on fuel consumption for different sizes of tractors was calculated from the Nebraska Tractor Tests Reports. The fuel consumption figures are based on "75% of Pull at Maximum Power". These fuel consumption figures are for tractors under normal load in average field conditions. Fuel use per hour will be affected by:-

- load factor (75% is assumed in these estimates)
- engine RPM
- gear
- correct engine tuning

While these figures may be a good indication of fuel use per hour for a machine, fuel consumption per acre will be affected by the Field Efficiency related to each operation. Estimation of total fuel consumption should take this factor into account. Some factors that can significantly affect field efficiency include:-

- wheel slippage
- tire pressure
- tractor ballast
- depth of and sharpness of implement
- soil type and condition
- amount of turning required
- implement overlap in each pass
- down time to refill seed and fertilizer boxes

MACHINERY COST WORKSHEET

Machine: Tractor - 100 HP | Original Cost: $45,000 | Annual Hours of Use: 600

Replacement Cost: $57,000 | Sale Value: $35,000 | Years of Use: 5

		Yearly Cost	Hourly Cost
FIXED COSTS (Calculated on Yearly Basis)			
1. Depreciation = Replacement Cost - Cash Sale Value / Years of Use	$57,000 - $35,000 / 5 Years	$4,400	
2. Investment Cost = Original Cash Cost + Cash Sale Value / 2 X Interest Rate	$45,000 + $35,000 / 2 x 10 %	$4,000	
3. Insurance & Housing = Original Cash Cost X 1%	$4,500 x 1 %	$450	
4. TOTAL FIXED COSTS PER YEAR		$8,850 (A)	
5. TOTAL FIXED COSTS/HOUR = Total Costs/Year/Hours of Annual Use	$8,850 + $600 hr		$14.75 (B)
VARIABLE COSTS (Calculated on Hourly Basis) (use following formulas if actual costs are not known)			
1. Fuel Cost = Litre/Hour X Price/Litre	23 x $.30 x	$6.90	
2. Lubrication = Fuel Cost X 15%	$6.90 x 15 %	$1.04	
3. Repairs = Original Purchase Price X Annual Repair Rate / Hours of Annual Use	$45,000 x 3 % / 600 hrs		$2.25
4. TOTAL VARIABLE COSTS PER HOUR			$10.19 (C)
5. TOTAL VARIABLE COSTS PER YEAR = Total Variable Costs/Hour X Hours of Annual Use	$10.19 x 600 hr	$6,114 (D)	

TOTAL COSTS PER YEAR (A+D) = $8,850 + $6,114	$14,964	
TOTAL COSTS PER HOUR (B+C) = $14.75 + $10.19		$24.94

MACHINERY COST WORKSHEET

Machine: Tractor - 100 HP | Original Cost: $ 45,000 | Annual Hours of Use: 800

Replacement Cost: $ 57,000 | Sale Value: $ 35,000 | Years of Use: 5

		Yearly Cost	Hourly Cost
FIXED COSTS (Calculated on Yearly Basis)			
1. Depreciation = Replacement Cost − Cash Sale Value / Years of Use	$ 57,000 − $ 35,000 / 5 Years	$ 4,400	
2. Investment Cost = Original Cash Cost + Cash Sale Value / 2 X Interest Rate	$ 45,000 + $ 35,000 / 2 x 10 %	$ 4,000	
3. Insurance & Housing = Original Cash Cost X 1%	$ 45,000 x 1 %	$ 450	
4. TOTAL FIXED COSTS PER YEAR		$ 8,850 (A)	
5. TOTAL FIXED COSTS/HOUR = Total Costs/Year/Hours of Annual Use	$ 8,850 ÷ $ 800 hr		$ 11.06 (B)
VARIABLE COSTS (Calculated on Hourly Basis) (use following formulas if actual costs are not known)			
1. Fuel Cost = Litre/Hour X Price/Litre	23 x $ .30 x	$ 6.90	
2. Lubrication = Fuel Cost X 15%	$ 6.90 x 15 %	$ 1.04	
3. Repairs = Original Purchase Price X Annual Repair Rate / Hours of Annual Use	$ 45,000 x 3 % / 800 hrs		$ 1.69
4. TOTAL VARIABLE COSTS PER HOUR			$ 9.63 (C)
5. TOTAL VARIABLE COSTS PER YEAR = Total Variable Costs/Hour X Hours of Annual Use	$ 9.63 x 800 hr	$ 7,704 (D)	
TOTAL COSTS PER YEAR (A + D) = $ 8,850 + $ 7,704		$ 16,554	
TOTAL COSTS PER HOUR (B + C) = $ 11.06 + $ 9.63			$ 20.69

MACHINERY COST WORKSHEET

Machine ..... **Original Cost** ..... **Annual Hours of Use** .....

Replacement Cost ..... **Sale Value** ..... **Years of Use** .....

		Yearly Cost	Hourly Cost
FIXED COSTS (Calculated on Yearly Basis)			
1. Depreciation = $\frac{\text{Replacement Cost} - \text{Cash Sale Value}}{\text{Years of Use}}$	$\frac{\$ \ldots\ldots - \$ \ldots\ldots}{\ldots\ldots \text{ Years}}$	$ _____	
2. Investment Cost = $\frac{\text{Original Cash Cost} + \text{Cash Sale Value}}{2}$ X Interest Rate	$\frac{\$ \ldots\ldots + \$ \ldots\ldots}{2}$ X ..... %	$ _____	
3. Insurance & Housing = Original Cash Cost X 1%	$ ..... X ..... %	$ _____	
4. TOTAL FIXED COSTS PER YEAR		$ _____ (A)	
5. TOTAL FIXED COSTS/HOUR = Total Costs/Year/Hours of Annual Use	$ ..... ÷ $ ..... hr		$ _____ (B)
VARIABLE COSTS (Calculated on Hourly Basis) (use following formulas if actual costs are not known)			
1. Fuel Cost = Litre/Hour X Price/Litre	..... X $ X	$ _____	
2. Lubrication = Fuel Cost X 15%	$ ..... X ..... %	$ _____	
3. Repairs = $\frac{\text{Original Purchase Price X Annual Repair Rate}}{\text{Hours of Annual Use}}$	$\frac{\$ \ldots\ldots X \ldots\ldots \%}{\ldots\ldots \text{ hrs}}$		$ _____
4. TOTAL VARIABLE COSTS PER HOUR			$ _____ (C)
5. TOTAL VARIABLE COSTS PER YEAR = Total Variable Costs/Hour X Hours of Annual Use	$ ..... X ..... hr	$ _____ (D)	

TOTAL COSTS PER YEAR (A + D) = $. ..... + $. ..... $ _____

TOTAL COSTS PER HOUR (B + C) = $. ..... + $. ..... $ _____

MACHINERY COST WORKSHEET

Machine ..... **Original Cost** ..... **Annual Hours of Use** .....

Replacement Cost ..... **Sale Value** ..... **Years of Use** .....

		Yearly Cost	Hourly Cost
FIXED COSTS (Calculated on Yearly Basis)			
1. Depreciation = $\frac{\text{Replacement Cost} - \text{Cash Sale Value}}{\text{Years of Use}}$	$\frac{\$ \ldots\ldots - \$ \ldots\ldots}{\ldots\ldots \text{ Years}}$	$ _____	
2. Investment Cost = $\frac{\text{Original Cash Cost} + \text{Cash Sale Value}}{2}$ X Interest Rate	$\frac{\$ \ldots\ldots + \$ \ldots\ldots}{2}$ X ..... %	$ _____	
3. Insurance & Housing = Original Cash Cost X 1%	$ ..... X ..... %	$ _____	
4. TOTAL FIXED COSTS PER YEAR		$ _____ (A)	
5. TOTAL FIXED COSTS/HOUR = Total Costs/Year/Hours of Annual Use	$ ..... + $ ..... hr		$ _____ (B)
VARIABLE COSTS (Calculated on Hourly Basis) (use following formulas if actual costs are not known)			
1. Fuel Cost = Litre/Hour X Price/Litre	..... X $ X	$ _____	
2. Lubrication = Fuel Cost X 15%	$ ..... X ..... %	$ _____	
3. Repairs = $\frac{\text{Original Purchase Price X Annual Repair Rate}}{\text{Hours of Annual Use}}$	$\frac{\$ \ldots\ldots X \ldots\ldots \%}{\ldots\ldots \text{ hrs}}$		$ _____
4. TOTAL VARIABLE COSTS PER HOUR			$ _____ (C)
5. TOTAL VARIABLE COSTS PER YEAR = Total Variable Costs/Hour X Hours of Annual Use	$ ..... X ..... hr	$ _____ (D)	

TOTAL COSTS PER YEAR (A + D) = $. ..... + $. ..... $ _____

TOTAL COSTS PER HOUR (B + C) = $. ..... + $. ..... $ _____

METRIC CONVERSION TABLE

1 hectare (ha)	=	2.5 acres
1 kilometre (km)	=	0.625 miles
1 metre (m)	=	3.3 feet
1 centimetre (cm)	=	0.39 inches
1 kilogram (km)	=	2.2 pounds
1 tonne (t)	=	1.1 tons or 2200 pounds
1 tonne (t)	=	36.7 bu. of wheat
	=	45.9 bu. of barley
	=	64.8 bu. of oats
	=	44.1 bu. of rapeseed
1 litre (l)	=	0.22 gallons
1 kilowatt (kw)	=	1.34 horsepower
1 acre	=	.4 hectares
1 mile	=	1.6 kilometres
1 foot	=	.3 metres
1 inch	=	2.5 centimetres
1 pound	=	.45 kilograms
1 ton	=	.91 tonnes
1 bu. of wheat	=	27.3 kilograms
1 bu. of barley	=	21.8 kilograms
1 bu. of oats	=	15.5 kilograms
1 bu. of rapeseed	=	22.7 kilograms
1 horsepower	=	.75 kilowatts
1 kilogram per hectare	=	0.9 pounds per acre (approx.)
1 pound per acre	=	1.1 kilograms per hectare (approx.)

If a fertilizer recommendation is given in kilograms per hectare and the machine is calibrated in pounds per acre, set the machine at 10% less than the recommendation to obtain the desired rate.

POOR

QUALITY

ORIGINAL